ProVac Global Initiative: a vision shaped by ten years of supporting evidence-based policy decisions

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A R T I C L E   I N F O

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A B S T R A C T

Introduction: The Pan American Health Organization (PAHO) created the ProVac Initiative in 2004 with the goal of strengthening national technical capacity to make evidence-based decisions on new vaccine introduction, focusing on economic evaluations. In view of the 10th anniversary of the ProVac Initiative, this article describes its progress and reflects on lessons learned to guide the next phase.

Methods: We quantified the output of the Initiative's capacity-building efforts and critically assess its progress toward achieving the milestones originally proposed in 2004. Additionally, we reviewed how country studies supported by ProVac have directly informed and strengthened the deliberations around new vaccine introduction.

Results: Since 2004, ProVac has conducted four regional workshops and supported 24 health economic analyses in 15 Latin American and Caribbean countries. Five Regional Centers of Excellence were funded, resulting in six operational research projects and nine publications. Twenty four decisions on new vaccine introductions were supported with ProVac studies. Enduring products include the TRIVAC and CERVIVAC cost-effectiveness models, the COSTVAC program costing model, methodological guides, workshop training materials and the OLIVES on-line data repository. Ten NITAGs were strengthened through ProVac activities.

Discussion: The evidence accumulated suggests that initiatives with emphasis on sustainable training and direct support for countries to generate evidence themselves, can help accelerate the introduction of the most valuable new vaccines. International and Regional Networks of Collaborators are necessary to provide technical support and tools to national teams conducting analyses. Timeliness, integration, quality and country ownership of the process are four necessary guiding principles for national economic evaluations to have an impact on policymaking. It would be an asset to have a model that offers different levels of complexity to choose from depending on the vaccine being evaluated, the availability of data, and the time frame of the decision.

Conclusion: Decision support for new vaccine introduction in low- and middle-income countries is critical to maximizing the efficiency and impact of vaccination programs. Global technical cooperation will be required. In the future, PAHO and WHO have an opportunity to expand the reach of the ProVac philosophy, models, and methods to additional regions and countries requiring real-time support. The ProVac Global Initiative is proposed as an effective mechanism to do so.

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1. Introduction

New vaccines prevent disease and save lives, but their high costs raise issues about value for money and affordability in developing countries. Evidence on the costs and benefits of introducing a
new vaccine is needed to support sustainable and rational decisions about the adoption of vaccines, as well as the subsequent planning to roll out a new vaccine once a decision has been made. The Pan American Health Organization (PAHO) created the ProVac Initiative in 2004 with the goal of strengthening the country-level technical capacity to make evidence-based decisions on new and under-utilized vaccine introduction in Latin America and the Caribbean, with a focus on economic evaluations [1]. (The term ProVac stands for promoting evidence-based decisions about vaccine introductions.) The ProVac Initiative was formalized in 2006 in response to a PAHO governing body request for increased technical assistance in evaluating the evidence for new vaccine introduction [2]. The initiative has a specific focus on establishing and building the technical capacity of national multi-disciplinary teams to perform economic studies [3]. In 2010, ProVac established a network of Regional Centers of Excellence (CoE), academic institutions that have helped to gather regional evidence and develop methodological guidelines and tools [4]. In 2012, following increased demand for ProVac tools and methods outside of the PAHO Region, an International Working Group (IWG) was formed to pilot-test the implementation of ProVac in the African, Eastern Mediterranean, and European regions. The IWG included PAHO, the World Health Organization (WHO), the US Centers for Disease Control and Prevention (CDC), PATH, Agence de Médecine Préventive (AMP), and the Sabin Vaccine Institute (Sabin). Results from this pilot are described in detail elsewhere in this supplement [5]. In 2013, PAHO member states more explicitly stated the need for support in PAHO’s Directing Council Resolution CD52.R14. The mandate requests specific support for (1) institutionalization of evidence-based decision-making process for new vaccine introductions, (2) integration of costing and planning performed by the Expanded Program on Immunization (EPI), and (3) expansion of the evidence base beyond cost-effectiveness. The mandate is aligned with the overall PAHO research policy and constitutes a practical and effective first step toward a health-technology assessment (HTA) approach. The ProVac approach has involved a clearly defined country-led process for developing evidence to inform decisions on the uptake of pneumococcal conjugate, rotavirus, and human papillomavirus (HPV) vaccines that increase ownership and trust in the results by national authorities, as shown in government websites and press releases [6,7]. Technical working group teams led by the ministries of health present the results of nationally owned cost-effectiveness, program-costing, and financing analyses to national authorities to aid technical evaluation of new vaccines and decisions about whether to adopt them. In more than 10 years of working directly with immunization programs, PAHO has learned many lessons about the infrastructure and processes that national immunization programs need for adequate evaluation of quality cost-effectiveness data or other economic data as part of the decision package. These lessons may offer some insight into strengthening a broader, health-sector approach to developing and using economic evaluations for making decisions about adopting health products and technology. The vision for the ProVac Initiative was described by Andrus and colleagues in 2007 [1]. The operational implementation was described in detail by the ProVac team in 2010 [3]. This article will provide an update to describe the Initiative’s progress in its first 10 years of existence and will evaluate this progress to identify best practices and recommendations to guide future efforts.

2. Methods

Since the project’s inception, process indicators have been routinely reviewed to monitor and document progress toward achieving the goal of strengthened national capacity around evidence-based decision-making for new vaccines. These process indicators were initially proposed in the project design phase. The planning and monitoring tools describe the proposed links between planned activities, outputs, and results. But they also help track progress, document achievement of milestones, and identify anything that needs to be revised in future phases of the project. Some additional indicators (marked with an asterisk **) have been developed in the course of implementation. These process indicators quantify the immediate output of the Initiative’s capacity-building efforts, including:

- Number of persons trained through regional workshops.
- Number of national ProVac teams formed.
- Number of ProVac-supported studies completed.
- Number of tools and instruments developed for country use.
- Number of national immunization technical advisory groups (NITAGs) strengthened through the creation or improvement of standard operating procedures (SOPs).
- Number of total analyses conducted by national teams that had already completed a previous analysis*.

This information was compiled and is presented as a descriptive summary in this article. We also critically assess how improving the process and infrastructure for decision-making has resulted in more countries adequately assessing available evidence and acting on it for decisions. Other qualitative information complements this analysis to predict the sustainability of these capacity-building efforts.

3. Results

Since 2004, ProVac has conducted 4 regional workshops that averaged more than 100 participants each and in which more than 20 countries were represented. Workshops have focused on training to develop cost-effectiveness data on Pneumococcal conjugate vaccine (PCV) (2008), rotavirus vaccine (2010), and HPV vaccine (2011), as well as immunization program-costing analyses (2013). Additionally, the ProVac IWG conducted 3 regional workshops outside the PAHO Region in 2012 and 2013. All these workshops have been essential to raising awareness about the use of economic evaluations for decision-making in health and to stimulating demand for national economic evaluations of new vaccines.

Each workshop resulted in several countries requesting technical support to conduct a country-led ProVac study. The few countries that did not request support following a regional workshop already had strong local institutional capacity to develop and implement cost-effectiveness models with the help of national universities, or already had considered the introduction of the vaccine that was discussed at the workshop. The requests were typically received by PAHO vis-à-vis PAHO country offices and the ProVac Initiative then supports the country’s ministry of health in convening a multidisciplinary national study team (i.e., the ProVac study team). The national teams coordinate with ProVac, its national immunization technical advisory group, and national immunization program. In total, ProVac has supported the creation of 15 national teams in the following PAHO countries: Argentina, Bahamas, Belize, Bolivia, Brazil, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Nicaragua, Paraguay, Peru, and Uruguay. In addition, the ProVac IWG supported the creation of national teams in 9 countries outside the PAHO Region: Albania, Azerbaijan, Croatia, Egypt, Georgia, Iran, Kenya, Senegal, and Uganda.

All 24 national ProVac teams have completed at least one economic evaluation to contribute to a national decision-making
Table 1
Published ProVac country studies of Latin America and the Caribbean: characteristics, results, and policy implications.

<table>
<thead>
<tr>
<th>Country</th>
<th>GAVI Eligibility</th>
<th>Vaccine</th>
<th>Schedule</th>
<th>Vaccine price over analysis time horizon (year 1) -&gt; (last year)</th>
<th>% Reduction of deaths</th>
<th>Net costs</th>
<th>DALYs averted</th>
<th>ICER</th>
<th>GDP pc (year)</th>
<th>CEA result</th>
<th>% Scenarios with ICER &lt;3xGDPpc (Total CE/Total evaluated)</th>
<th>Country decision</th>
<th>Justification for single product evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Not eligible</td>
<td>RV1</td>
<td>2</td>
<td>$7.50 (2012) -&gt; $6.25 (2021)</td>
<td>70.80%</td>
<td>$24,923,806</td>
<td>6,440</td>
<td>$3,870</td>
<td>$9,090 (2011)</td>
<td>Highly cost-effective</td>
<td>93% (13/14)</td>
<td>RV1 introduced in 2015.</td>
<td>N/A (both products were evaluated)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RV5</td>
<td>3</td>
<td>$5.15 (2012) -&gt; $4.29 (2021)</td>
<td>79.20%</td>
<td>$16,894,756</td>
<td>7,000</td>
<td>$2,414</td>
<td></td>
<td>Highly cost-effective</td>
<td>93% (13/14)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belize</td>
<td>Not eligible</td>
<td>HPV</td>
<td>3</td>
<td>$13.79</td>
<td>63.60%</td>
<td>$69,605</td>
<td>162</td>
<td>$429 ($ societ al perspective)</td>
<td>$7,663</td>
<td>$4,795 (2012)</td>
<td>Highly cost-effective</td>
<td>100% (10/10)</td>
<td>Decision pending.</td>
</tr>
<tr>
<td>Brazil</td>
<td>Not eligible</td>
<td>HPV</td>
<td>3</td>
<td>$13.19</td>
<td>43.40%</td>
<td>$51,167,398</td>
<td>6,677</td>
<td>$8,121</td>
<td>$51,167,398 (2012)</td>
<td>Highly cost-effective</td>
<td>100% (20/20)</td>
<td>HPV4 introduced in 2014.</td>
<td></td>
</tr>
<tr>
<td>Honduras</td>
<td>Eligible</td>
<td>HPV</td>
<td>3</td>
<td>$13.45</td>
<td>61.80%</td>
<td>$4,029,588</td>
<td>4,349</td>
<td>$926</td>
<td></td>
<td>Highly cost-effective</td>
<td>95% (19/20)</td>
<td>Decision pending.</td>
<td>Model does not allow for product comparison.</td>
</tr>
<tr>
<td>Paraguay</td>
<td>Not eligible</td>
<td>PCV10</td>
<td>2 + 1</td>
<td>$14.85</td>
<td>27.60%</td>
<td>$47,474,013</td>
<td>12,328</td>
<td>$3,851</td>
<td>$2,516 (2009)</td>
<td>Cost-effective</td>
<td>90% (18/20)</td>
<td>PCV10 introduced in 2012 due to increased cost savings and procurement through PAHO Revolving Fund</td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>Not eligible</td>
<td>PCV13</td>
<td>2 + 1</td>
<td>$20.00</td>
<td>32.60%</td>
<td>$69,126,188</td>
<td>14,106</td>
<td>$4,901</td>
<td>$6,573 (2012)</td>
<td>Cost-effective</td>
<td>85% (17/20)</td>
<td>100% (19/20)</td>
<td>PCV13 introduced in 2012.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCV10</td>
<td>2 + 1</td>
<td>$14.24 (2012) -&gt; $9.70 (2031)</td>
<td>34.30%</td>
<td>$363,268,692</td>
<td>226,370</td>
<td>$1,605</td>
<td>$1,524 (2010)</td>
<td>Highly cost-effective</td>
<td>100% (19/20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCV13</td>
<td>2 + 1</td>
<td>$16.34 (2012) -&gt; $11.13 (2031)</td>
<td>47.40%</td>
<td>$408,264,249</td>
<td>313,119</td>
<td>$1,304</td>
<td></td>
<td>Highly cost-effective</td>
<td>100% (19/19)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Study results in this table reflect the government perspective unless noted otherwise. With the exception of vaccine prices, all dollar amounts shown here have been rounded to nearest USD.

* TRIVAC model for PCV and RV has ability to evaluate stacked cohorts to assess trends such as vaccine price declines; CERVIVAC model used for HPV only allows evaluation of one single girl cohort.

** All benefits and costs were discounted 3% in the base case, except for Brazil and Costa Rica, which used 5% discount for costs and benefits.
process on new vaccines. Several countries (n = 6) have completed two or more studies with the support of ProVac technical assistance and tools. The lengthiest study required 16 months to complete and the shortest studies were completed in barely a month; the average time was 6 months and the median was 5 months. The key issues determining the length of a study were local pressure to have evidence ready in time for a decision and the availability of quality inputs, two of the four principles for relevant economic evaluations, identified by the ProVac Initiative (described below) [9]. Both instances where the ProVac studies were conducted in a month were in islands of the Caribbean where local data were already available and there was pressure to finish the studies quickly to ensure that they could be used to inform a decision that had to be made before the end of the year.

In total, results from 24 nationally owned cost-effectiveness analyses (PCV = 9, Rota = 2, HPV = 11) and two EPI costing and financial analyses in LAC have been presented to national authorities to aid decision-making, including both NITAGs and high-level authorities at ministries of health and several of them have been published in peer reviewed journals (Table 1). Similarly, the ProVac IWG has supported 9 analyses on the introduction of vaccines (4 for PCV and 5 for rotavirus vaccines), as well as the communication of the results to high-level decision-makers in the respective countries. Based on the currently available data on new vaccine introduction status, all Latin American and Caribbean (LAC) countries that requested support for a PCV or rotavirus cost-effectiveness analysis (CEA) have introduced or plan to introduce the vaccine. Cost-effectiveness analyses on HPV vaccine have not yet been followed by final decisions likely because the analyses had only recently been completed, and because vaccine prices remain high at time of analysis.

By the end of 2013, ProVac had received 43 official requests from 27 countries for support to develop an economic analysis (Table 2); 16 were from LAC and 11 from other regions. Twenty requests were for a CEA of PCV, 5 for a CEA of rotavirus vaccine, 12 for a CEA of HPV vaccine and 6 for an EPI cost analysis. Eleven of the requests are still unfunded for 2014 and 2015; ProVac and the partners are working collaboratively to mobilize funds to support these pending requests. About half of the unfunded requests are from ProVac teams that have already received training and are familiar with the tools and another half are a result of unmet demand for training and tools in the IWG pilot regions of Africa, Eastern Mediterranean, and Europe [5].

A number of tools, training programs, and guidance instruments have been developed under the ProVac Initiative umbrella since 2004. All tools were field tested, reviewed by expert groups and then launched at ProVac regional workshops to promote them among potential users and test their capacity to respond to real policy questions at country-level. These enduring products of the initiative include:

- An On-line Immunization and Vaccines Economics and Statistics data repository (OLIVES) and other technical materials.
- A model to evaluate the impact and cost-effectiveness of Hib, rotavirus and pneumococcal vaccination (TRIVAC) [8].
- A model to evaluate the impact and cost-effectiveness of cervical cancer screening and HPV vaccination (CERIVAC).
- A model to estimate the cost of the EPI program and to estimate the incremental cost and budget impact of adding new vaccines (COSTVAC) [9].

ProVac has also created instruments for data collection on pneumococcal, rotavirus and HPV-related disease diagnosis and treatment costs. In addition to its framework for supporting country-led economic evaluations, the ProVac Initiative has prioritized the establishment and strengthening of NITAGs. These advisory bodies play a critical role in guiding an objective and transparent decision-making process for immunization policy by providing independent recommendations grounded in evidence to Ministry of Health [10]. As technical advisory committees, NITAGs are one of the key audiences for the cost-effectiveness results generated by ProVac national teams. Since 2004, 16 countries have established a NITAG or received NITAG training from the ProVac Initiative on evidence-based decision-making [11]. Two of these countries have revised their standard operating procedures with guidance from the PAHO NITAG guideline [12,13]. The CDC, the US Advisory Committee on Immunization Practices (ACIP) and the Sabin Vaccine Institute have been crucial partners in these efforts.

### 4. Discussion

The main aim of ProVac is to strengthen country-level capacity to make informed decisions about the introduction of new vaccines.
Consequently, the adoption of a new vaccine is not its ultimate goal. ProVac does not push the introduction of new vaccines with advocacy messages or tools; rather, it advocates for evidence to guide governments in making priority setting decisions. But introducing new vaccines is, to a certain extent, an undeniable measure of the impact of ProVac, particularly when the vaccine in question has been proven to be cost-effective in a variety of country contexts.

In this regard, at least 3 of every 4 decisions supported with ProVac studies resulted in the introduction of a new vaccine. Furthermore, all of the decisions supported with the TRIVAC model resulted in the introduction or plans for a 2014 introduction of PCV or rotavirus vaccine in LAC. Since the CERVIVAC analyses are more recent, their impact on HPV vaccine introduction is yet to materialize. Some of the countries that did not conduct a ProVac study in LAC (such as Colombia, and Mexico) have existing technical capacity to conduct studies without the capacity-building support ProVac provides. Other countries may not have deemed it necessary to conduct an economic evaluation before introducing a new vaccine because other evidence (e.g., WHO recommendations) strongly promoted introduction into the national schedule.

This suggests that initiatives such as ProVac, which put the emphasis on sustainable training and direct support for countries to generate evidence themselves, can help accelerate the introduction of the most valuable new vaccines. Experience indicates that some challenges need to be addressed in the future to make the most of the international and national efforts involved and thus maximize impact on the decision-making process.

Key lessons learned from ProVac’s experiences providing technical support to countries can be summarized as follows:

### 4.1. Lessons about regional networks of experts

The ProVac Initiative has created a network of ProVac Centers of Excellence in the PAHO Region, a group of academic institutions with the aim of developing tools and practical guides for country use. In a phase two we intend to broaden the network of ProVac collaborators. In addition to experts from regional universities, collaborators will include key ministry of health and NITAG professionals, and experts from international, regional, and local agencies. The regional network will serve as an advisory and expert panel, reviewing ProVac’s models and guidelines to provide a regional “reality check.” The network will also provide peer review for publications and the results of country studies, offer technical support to national teams on specific issues, and promote regional exchanges and collaboration.

The participation of regional collaborators and the active involvement of NITAGs give the ProVac core team greater understanding of the regional context. Supporting regional academics and national advisory bodies is part of the capacity-building process for countries, exposing them to large-scale global initiatives with enhanced peer-to-peer exchanges while improving ProVac’s ability to create useful and practical tools and methods.

### 4.2. Lessons about the technical support provided to countries

In these first 10 years of implementing ProVac, the lessons around providing technical assistance to countries to develop country-led cost-effectiveness analyses have led to the definition of four key principles for increasing the potential impact of economic evaluations on policymaking: Timeliness, Integration, Quality and Ownership/Institutionalization (Box 1).

<table>
<thead>
<tr>
<th>Box 1: Principles for national economic evaluations with impact on policymaking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeliness</td>
<td>Economic analyses and other pieces of evidence are most useful when the results are ready to respond to a specific policy question. ProVac experience demonstrates that CEA that intend to inform an adoption decision are often used as advocacy instruments if results arrive too late. On the other hand, there were several instances where CEA results were useful for decision makers that needed additional evidence to defend a decision already in place.</td>
</tr>
<tr>
<td>Integration</td>
<td>Economic analyses need to be adequately contextualized and complemented with all the necessary information to answer a relevant policy question, even by adopting an HTA approach when feasible.</td>
</tr>
<tr>
<td>Quality</td>
<td>Results from an economic evaluation require quality inputs. Part of this process is evaluating the quality of evidence and ProVac experience demonstrates the utility in doing this at the local level. Poor quality data leads to poor quality results and, worst yet, poor decisions.</td>
</tr>
<tr>
<td>Ownership/ institutionalization</td>
<td>The development of an economic analysis needs to be owned by nationals, for them to understand its limitations, to interpret its results correctly, and to trust it enough to let them influence their decision. National ownership and institutionalization of the process leads to more rapid and better informed policy decisions.</td>
</tr>
</tbody>
</table>

In our experience, these four principles for high-impact economic evaluations interact closely with each other, and all four are needed for an economic evaluation to have real impact on national decision making. These principles were defined from observing many unexpected outcomes from the ProVac process at country level that contributed to ‘added-value’ for conducting a cost-effectiveness analysis. In other words, these unexpected process outcomes (examples summarized in Table 3) demonstrated that there are benefits of conducting a country-owned economic evaluation that go far beyond obtaining results from the analysis, making the effort to hand over the process to country teams even more worthwhile.

Finally, after an economic evaluation is concluded, countries often grapple with other unanswered questions, particularly if the analysis only assessed the value of a single health intervention. We therefore propose to support comparative analyses with different layers of model complexity (UNIVAC, see below).

### 4.3. Lessons on cost-effectiveness models for country use

Learning from the extensive technical support provided to countries throughout the years, and to ensure that the four principles for relevant economic evaluations are followed in the future, ProVac has envisioned a new single cost-effectiveness model framework, UNIVAC. UNIVAC will build on the modelling work to develop TRIVAC and CERVIVAC. It will be a single, flexible and consistent framework that can be quickly adapted to the needs of a particular vaccine and particular country. A single flexible model will also allow for head-to-head comparisons of different vaccines as well as non-vaccine health interventions, enhancing the model’s usefulness in real-life public policy decisions.

The availability of data often varies from country to country, so there is a need to tailor models to the available local data. It would be an asset to have a model that offers different levels of complexity to choose from depending on the vaccine being evaluated, the availability of data, and the time frame of the decision.
Table 3
Published ProVac country studies of Latin America and the Caribbean: additional benefits from the ProVac approach.

<table>
<thead>
<tr>
<th>Country</th>
<th>Additional benefits from ProVac approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Acting staff has developed three CEAs with ProVac and quickly adapts tools to country needs as a result of the staff member's honed technical skills with ProVac tools. MOH EPI established salaried position to support vaccine policy research as an input to NITAG discussions and MOH policymaking</td>
</tr>
<tr>
<td>Belize</td>
<td>High documented out-of-pocket costs and minimal access to treatment services for cervical cancer in country during study promoted actionable dialogue among key actors</td>
</tr>
<tr>
<td>Brazil</td>
<td>Collaboration between a regional academic center of excellence working with ProVac and the Brazilian MOH offered unique opportunity to bridge between academia and real time policymaking</td>
</tr>
<tr>
<td>Honduras</td>
<td>Working group established between EPI and cervical cancer groups to develop an HPV CEA study and still continues to meet to promote inter-programmatic approach to HPV introduction and screening infrastructure strengthening</td>
</tr>
<tr>
<td>Paraguay</td>
<td>Paraguay MOH EPI emitted ministerial decree to support evidence-based approach to policy development for this study and in the future based on the ProVac experience</td>
</tr>
<tr>
<td>Peru</td>
<td>The existing national health institute in charge of conducting economic evaluations worked closely with the EPI ProVac team and relationships were strengthened for future collaborative studies</td>
</tr>
</tbody>
</table>

4.4. Lessons on international comparisons of national cost-effectiveness data

The studies conducted have each adhered to recognized standards for economic evaluations of vaccines [14] and a consistent model has been used for each vaccine. There are, however, several reasons why the base-case results presented by different countries may not be directly comparable. For example, two of the LAC studies used a 5% discount rate (Brazil, Costa Rica) rather than 3%. Five countries presented head-to-head vaccine evaluations (PCV10 vs. PCV13) while others focused on a single vaccine. Some countries considered a longer time horizon than others (four countries used 10 years rather than 20). And while most countries considered both a government and societal perspective, a few countries presented only a government perspective, some presented just the societal, and one presented 3 different perspectives. In addition, there was variation in the year of vaccine introduction and the year in which costs were presented, as well as country-specific assumptions about herd effects, waning, inclusion or exclusion of sequelae costs, and inclusion or exclusion of lost productivity.

These variations make direct comparisons of model results between countries challenging. However, such comparisons are not the aim of the ProVac Initiative. Rather, each study is tailored to country circumstances and the concerns of its decision-makers, which is important to national credibility and ownership and ultimately usefulness of the study results in the decision. The ability to incorporate decision-makers’ preferences, the perspectives that are most relevant to the country, and data that reflects the local context makes it possible to construct a base-case scenario that national teams understand and feel confident defending. Thus, while this limits the scope of country-to-country comparisons, it allows for more effective ownership and transfers of knowledge to national teams—and, crucially, produces better local acceptance when results are presented to national committees.

4.5. Lessons for a way forward: The ProVac Global Initiative

Building upon ProVac’s 10 years of experience, we propose creating a ProVac Global Initiative with several innovative characteristics. Priority areas over five years include:

- Strengthen infrastructure for decision-making.
  1. **At the global level:** Establish ProVac core teams in all WHO regional offices to provide a regional focal point for economic evaluations of vaccines and potentially broader HTA studies.
  2. **At the regional level:** Create regional networks of experts to review models and data, and to work with national teams.
  3. **At the national level:** Form ProVac national multidisciplinary teams to conduct economic and financial analyses, including cost-effectiveness, comprehensive EPI costing, expenditure tracking, and financial-flows analyses.

- Expand the current suite of economic tools (TRIVAC, CERVIVAC, COSTIVAC) to support country-level policy needs in the future, such as vaccines for dengue, meningococcal, malaria, hepatitis A, and cholera.
- Use regional workshops and direct country support to focus training on generating evidence for sustainable introduction of new vaccines and allocation of EPI resources.
- Support national teams as they conduct cost-effectiveness, impact and financial analyses.
  1. Interpret results and create alternative scenarios.
  2. Effectively communicate results to decision-makers.
  3. Provide peer review.
- Support to NITAGs and policymakers with policy briefs and capacity building efforts.

5. Conclusion

PAHO’s work to strengthen evidence-based immunization policy in the Americas with the building of capacities to generate, interpret and incorporate economic evidence in the decision making process has clearly contributed to a positive shift in policy-making for immunization programs. The fact that all 14 published cost-effectiveness analyses in this supplement alone were led by national teams is a good indicator of the degree of genuine country involvement and a reflection of the success of the initiative. Other country teams have sought publication elsewhere or are currently preparing articles for submission [15]. The lessons learned during the 10 years of the initiative in the Americas will guide future implementation. The ProVac Global Initiative is proposed as an effective mechanism to provide support to national governments for generating sustainable technical capacity for evidence-based decisions on new vaccines.

Conflict of interest statement

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